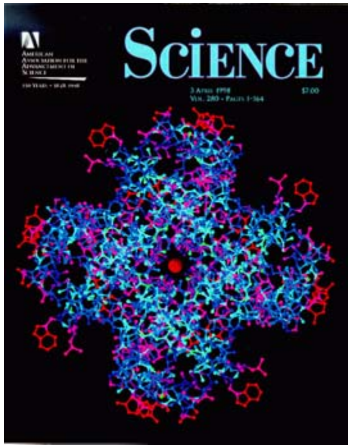
Rod MacKinnon wins 2003 Chemistry Nobel

CORNELL

CHESS: DMR-225180

Dr. Rod MacKinnon of Rockefeller University is co-recipient of the 2003 Nobel Chemistry prize for determining the structure and function of membrane ion channels. Membrane channels allow selective passage of ions, such as Cl^-, or Na^+, across biological membrane. These ion currents are responsible for many cellular functions, such as nerve transduction.

The break-through structure of a K^+ channel, using x-ray data acquired at CHESS, electrified the world when it was published in *Science* in 1998. Subsequent work by Dr. MacKinnon revealed the structure of other channels, the mechanisms of rectification, selectivity, and gating. Most of the x-ray data for this body of work has been acquired at CHESS, with the bulk of the remainder acquired at the National Synchrotron Light Source at BNL.



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Takeshi Egami wins 2003 Warren Prize for studies on disordered crystals

CHESS: DMR-225180

The Bertram Warren Award of the American Crystallography Association for 2003 has been presented to Dr. Takeshi Egami, University of Tennessee - Oak Ridge National Laboratory Distinguished Scientist, in recognition of his use of atomic PDF (pair distribution function) analysis of disordered crystals using pulsed neutrons and synchrotron x-rays.

From 1996 to 2002, Takeshi Egami, his colleagues and collaborators from other institutions received many weeks of the beam time at CHESS trying different experimental set-ups, verifying different algorithms for the data analysis, and extending this technique to different classes of materials. This research resulted in numerous publications, presentations,reports, and, finally, in the prestigious B.E.Warren Diffraction Physics Award.

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Compton Award for resonant magnetic work started at CHESS

CHESS: DMR-225180

APS Editor-in-Chief Martin Blume has been awarded the 2003 Arthur H. Compton Award by Argonne National Laboratory's Advanced Photon Source facility, along with L. Doon Gibbs, Kazumichi Namikawa, and Denis B. McWhan.

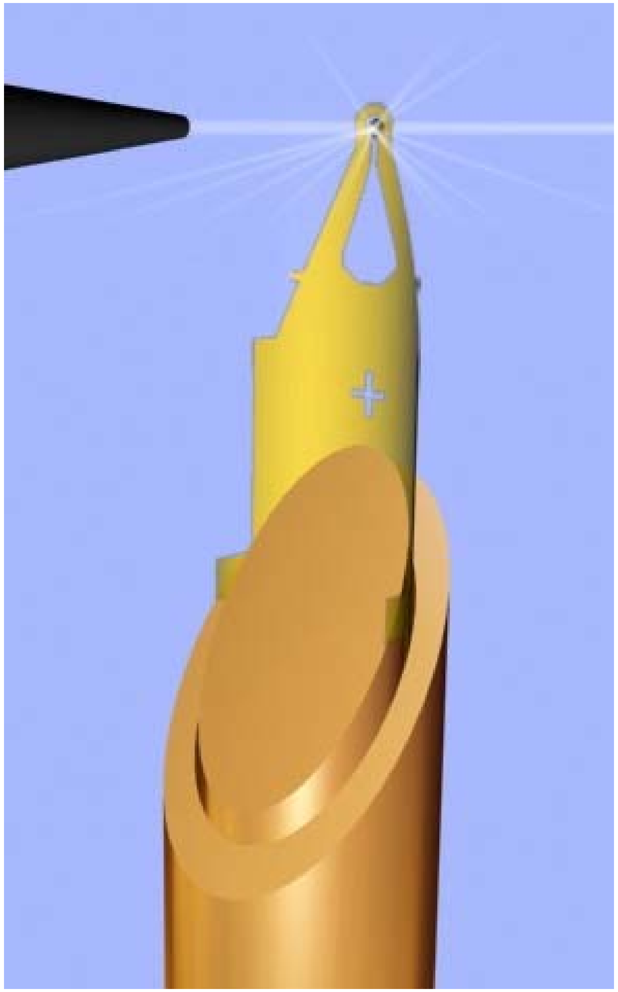
Martin Blume

Magnetic resonance scattering was first predicted in 1985 by Blume in a seminal theoretical paper in the *Journal of Applied Physics*, in which he derived the magnetic scattering cross section in a quantum mechanical formalism readily understandable by experimentalists. The effect was first observed experimentally by Namikawa and colleagues at the Photon Factory in Tsukuba, Japan. Large resonance enhancements, which put resonance scattering into the consciousness of the synchrotron community, were observed in 1988 at the Cornell High Energy Synchrotron Source by a team led by Gibbs and McWhan. The ensuing paper on the subject had a profound influence and impact on the x-ray and magnetism communities, clearly establishing x-rays as a viable alternative to neutrons for the study of magnetic structure [Physical Review Letters **61**, 10, 1241-1244 (1988)].

Novel Microfabricated Mounts for Macromolecular Crystallography

CHESS: DMR-225180

In 1990 MacCHESS scientist Teng introduced the cryoloop freezing method, a crucial step in ushering in the protein structural revolution of the last decade. A new development by Cornell physicist Rob Thorne now promises to, again, revolutionize the way in which protein structural data are acquired.



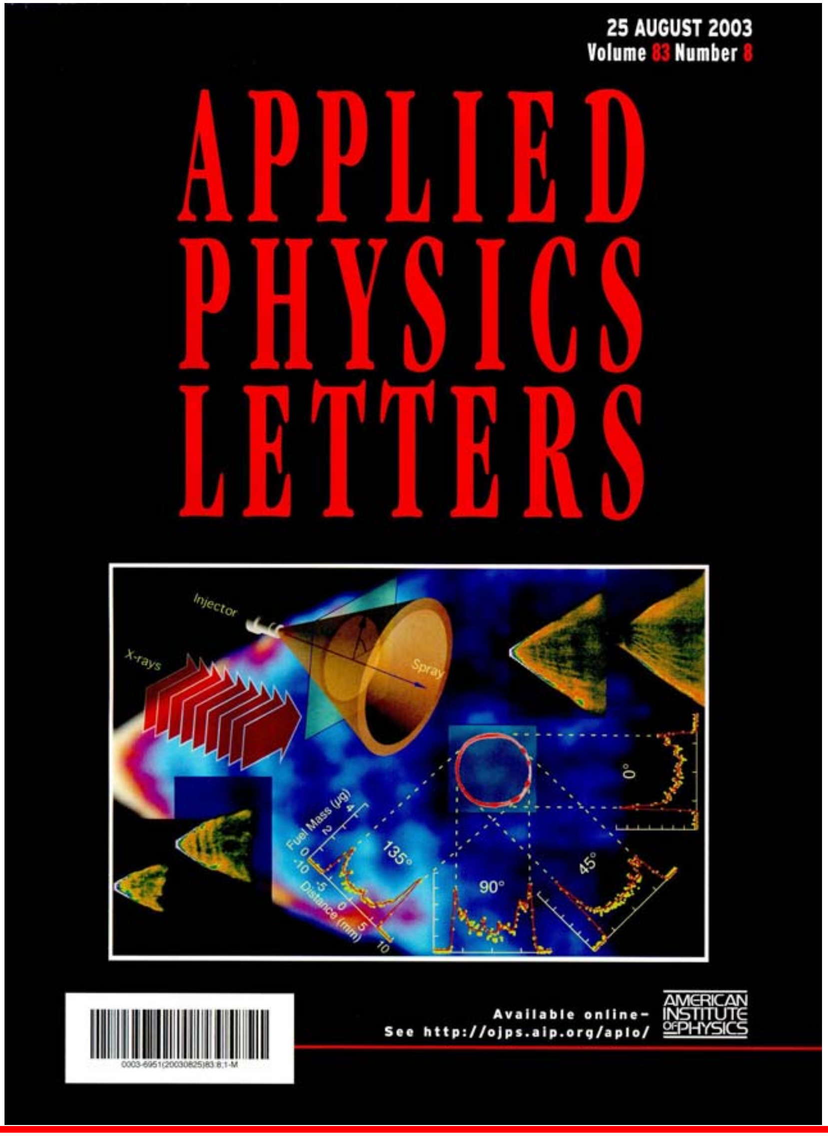
Thorne's sample mounts are prepared by photolithographically patterning thin polyimide films at the NSF-supported Cornell Nanofabrication Facility. The patterned structures contain a small hole for a tiny protein crystal connected to a larger hole via a drainage channel, allowing removal of excess liquid and easier manipulation in viscous solutions. The thin film and drainage structure reduces the x-ray background scatter, which is the key requirement for microcrystallography and challenging low-contrast diffraction imaging.

Cornell

Quantitative analysis of fuel sprays by time-resolved x-radiography

CHESS: DMR-225180

The groups of Gruner (Cornell) and Wang (Argonne National Laboratory) brought together a new, fast x-ray Pixel Area Detector and large, high intensity synchrotron x-ray beams to capture streaming images with microsecond resolution of the high-pressure liquid fuel sprays found in internal combustion engines. Images like these show striking, unexpected details and instabilities in the flow dynamics of gasoline fuel injectors. The results were recently featured in *Applied Physics Letters* (right).

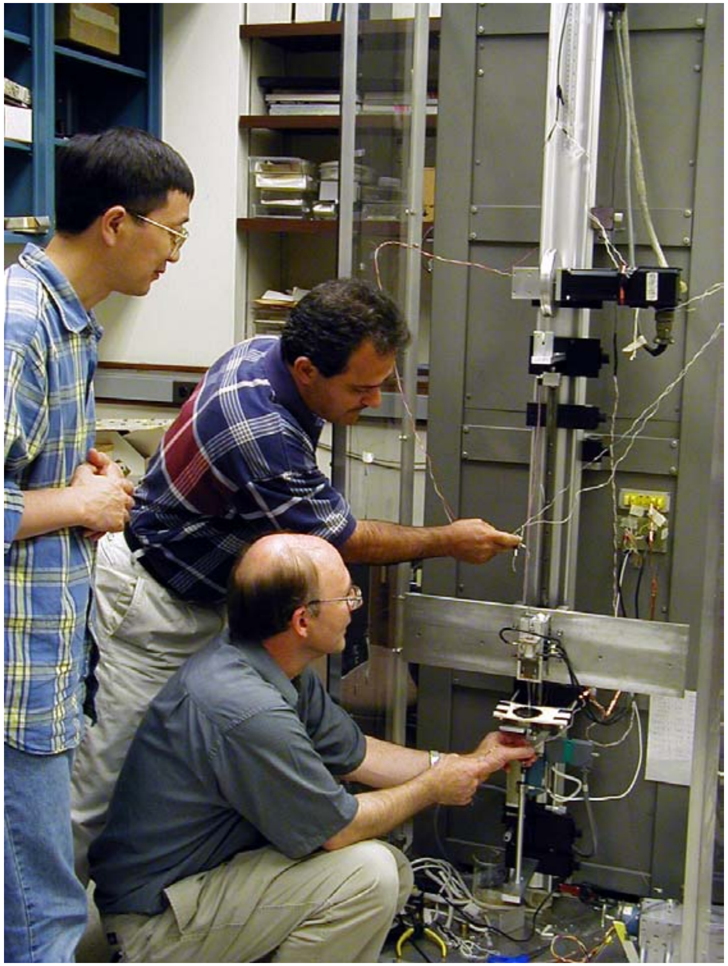


Detailed results such as these results will help engineers design more efficient injectors and internal combustion engines.

CHESS Research Experiences for Teachers (RET)

CHESS: DMR-225180

Massoud Assadi (Cody High School, Detroit, MI) spent the summer of 2003 working with the Microbeam Optics Group at CHESS. Microbeam applications at CHESS include scanning fluorescence probes for environmental specimens, such as probing for heavy metal contamination in plant leaves, and microcrystallography, where they illuminate tiny protein crystals and collect diffraction images needed to determine the atomic structure of proteins and viruses. Massoud (shown in center) worked to improve the capillary metrology using accurate video camera images to measure the shape of the tapered glass x-ray 'funnels'.

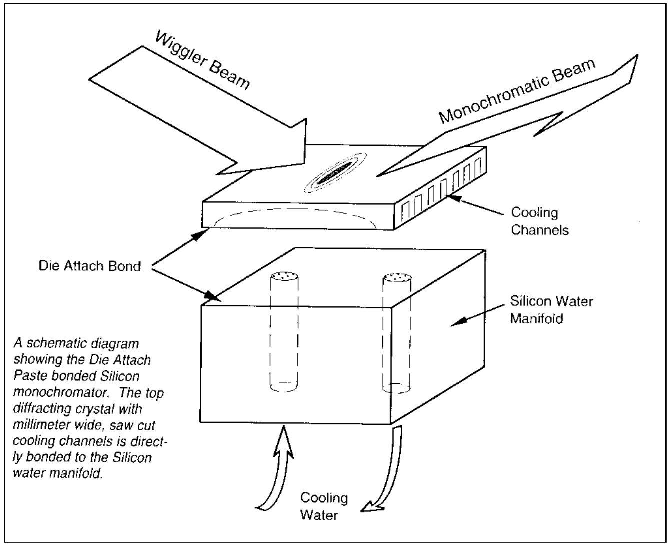


CHESS Research Experiences for Teachers (RET)

CHESS: DMR-225180

Nasreen Jelili (Cody High School, Detroit, MI) spent the summer of 2003 studying imperfections and strain in silicon crystals in order to better understand how x-ray optics are perfected. The intense x-ray beams at CHESS cause the crystals to heat excessively, leading to a thermal bump that distorts the crystal and can lead, in extreme cases, to breakage of the optics (top graphic).

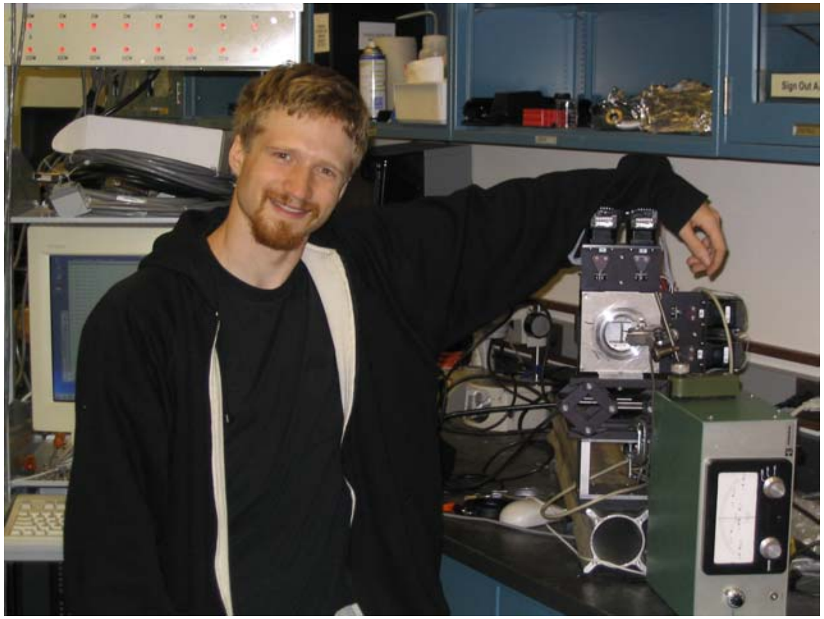
Flowing water through the crystals helps keep them cool but often strains the crystals. Nasreen worked on a device that measures the perfection of the crystals and shows highly images of the strain field on the surface.



CHESS Outreach and Education
Undergraduate student training

CHESS: DMR-225180

As a recent Cornell undergraduate seeking some real-world experience in physics, Rick Clinite spent the summer of 2003 working on technical upgrades to the CHESS D1 small-angle scattering station. He successfully interfaced remotely controlled x-ray slits with the station control software SPEC and troubleshot using them at the D1 beamline station. He worked with CHESS Computer Specialist Phil Sorensen learning how to configure and test each motor, as well as write and debug macro language software that moved the multiple slits in useful ways. This was the first time this type of motor controller has run at CHESS.



Rick learned a lot from his time at CHESS and has decided to apply to graduate school to study physics next year.